

## CATALYTIC STEAM REFORMING OF OXYGEN-CONTAINING COMPOUNDS

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Literature on the steam reforming of oxygen-containing compounds is limited to the two categories of simple alcohols and oxygenated aromatic compounds. A better understanding of mechanisms of both thermal decomposition and catalytic reforming reactions of oxygenates is needed in our process research and development to produce hydrogen from biomass. In this process, biomass is converted in high yields into vapors or oils composed of mainly oxygenated organic compounds. Our goal is to find a catalyst formulation that can reform both the complex and simple molecules present in the pyrolysis products while limiting undesirable side reactions that will lower the yields of hydrogen. In addition, optimal operation conditions will be established that will result in long term catalyst activity.

We have initiated studies on steam reforming reactions of model oxygen-containing compounds using a plug-flow microreactor interfaced with a molecular beam mass spectrometer (MBMS). The uniqueness of the MBMS sampling system is its rapid, real-time, and universal detection of gaseous and condensable products. A series of model oxygenated compounds, biomass and other lignocellulosic materials has been screened using commercial, Ni-based catalysts. Almost complete conversions were observed in most cases under reaction conditions of moderate severities. We will compare activities of a shift conversion catalyst, several commercial reforming catalysts, and a research catalyst. The effects of operating conditions such as temperature, steam-to-carbon ratio, residence time, and space velocity on steam reforming reactions of four model compounds, methanol, acetic acid, hydroxyacetaldehyde, and 4-allyl-2,6-dimethoxyphenol, will be examined. Mechanistic studies on the competition between thermal decomposition and reforming reactions of these model compounds will be presented and discussed.

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